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AUTOMATIC MUSCULAR MOVEMENTS AMONG THE  
INSANE; THEIR PHYSIOLOGICAL  
SIGNIFICANCE.

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Recent physiological research recognizes the significance of the relationship between muscular movement and cell activity of the central nervous system. Hughlings Jackson has said "that the whole brain is made up of structures that subserve sensori-motor processes, and that into such processes all its functions may be resolved." Gowers likewise remarks "that every structure of the brain concerned with sensation proper is connected directly or indirectly with a part concerned with motion." These views have received fresh recognition and confirmation in Dr. Francis Warner's interesting volume on "Physical Expression," and in a recent article by the same writer in the *Journal of Mental Science*, April number, 1889.

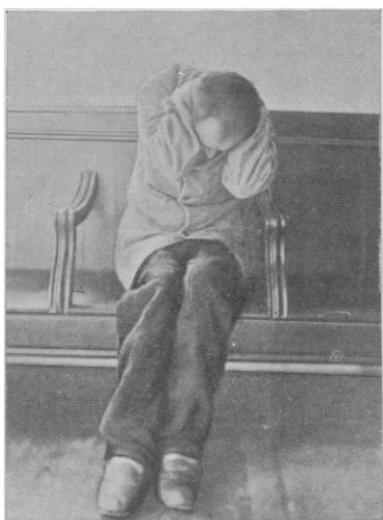
This intimate relationship between functional activity of the central nervous system and muscular movement is well illustrated by Dr. Warren P. Lombard, in an article, entitled, "The Effect of Fatigue on Voluntary Muscular Contractions," which appeared in the *American Journal of Psychology*, January number, 1890. The interesting experiments made by Dr. Lombard demonstrated the fact that the fatigue attendant upon continuous voluntary muscular exertion, and the consequent periodical variation in the strength of voluntary muscu-



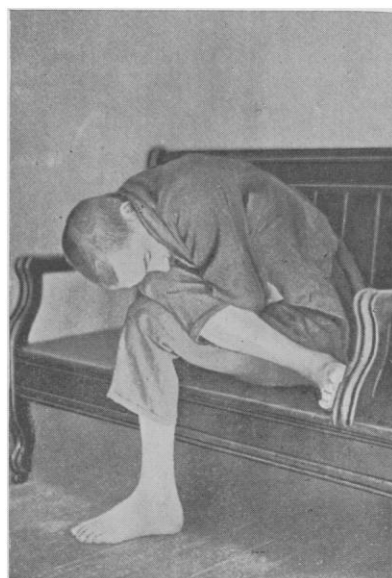
CASE. I.  
Melancholia with Stupor.



CASE II.  
Melancholia with Stupor.



CASE III.  
Chronic Dementia.



CASE IV.  
Chronic Dementia.

lar contractions is due to alterations "in some of the central nervous mechanisms which lie between the areas of the brain which originate the will impulse, and the centrifugal nerves." Although the nature of these alterations in the central nervous mechanisms is not explained, still the close relationship between automatic functional activity of the central nervous system and the muscular periphery is clearly established. Muscular movement, whether of the face or other parts of the body, represents cerebral cell activity. That mysterious property which, for want of a better name, we call nerve-force, is undoubtedly being constantly generated and stored up within the brain cells, and, upon the presentation of the proper stimulus, is as regularly discharged from them. The laws, which govern this elimination of nerve-force, are similar to the laws governing force in general. The great law of conservation of force or energy prevails in the field of cerebral cell activity as elsewhere. When chemical or other changes take place within the delicate nerve centres of the brain as a consequence of external stimulation through the senses, or internal stimulation following mental activity, the result conforms to the requirements of this universal law. Either the force generated by these chemical changes remains stored up in the cerebral cells as potential energy, to be called forth at some future time by stimulation, or it is transferred from the cells along the proper efferent tracts to the muscular system, and appears as motion. This is the physiological explanation of physical expression.

Now a certain constant and regular transmission of this nerve-force, from central cells to the muscular periphery, is natural and in accordance with a state of health. Indeed, a condition of what we call general good health demands this outward relief for the potential energy constantly accumulating within the brain cells. Thus the excessive muscular activity of all young and growing animals, the playfulness of young dogs and kittens, the pranks and follies of boyhood, are oftentimes merely the expression of this great natural law. In adult life, the potential energy of the cerebral cells is manifested in more practical and useful ways, but still in the more tangible results of a successful business, professional or

mechanical life, we recognize the outward manifestation of the potential energy which has been stored up within the brain cells until the proper stimulation called forth its discharge.

This intimate relationship between muscular movement and central cell activity within the cerebrum, has been discussed in Dr. Francis Warner's writings already referred to. This author calls attention to the fact that these outward manifestations of central cell activity begin at birth, and are witnessed in the countless random and meaningless movements of infancy, to which he has given the name of *microkinesis*. Undoubtedly, at a very early age, healthy inhibition of muscular movement begins. One by one useless and superfluous movements are checked, eliminated or co-ordinated in such a way that when adult life is reached, the individual, if in health, manifests those muscular activities which subserve the general purposes of the will and intelligence. Even at this period of life many movements remain fulfilling no particular purpose, but representing mere automatic cell activity, which has either been acquired by the individual or transmitted to him by heredity. The various movements and positions of the facial muscles, which, in their totality, make up the individual physiognomy, belong to this automatic and acquired class. Facial muscular action repeated in the same manner for months and years will, as Schack says, end by impressing "permanency and stability" upon those very lines which were at first only fleeting in character. It is undoubtedly in this mechanical way that heredity, the character of the social, intellectual, and moral life of the individual moulds the physiognomy, by continuous action of certain cerebral centres upon the terminal muscular expansions in the facial region. Facial expression, therefore, is only one of a large class of automatic and involuntary muscular movements that follow central cell activity within the cerebrum.

The close relationship between automatic muscular movement and the inhibitory power renders a study of the latter quite essential to a complete understanding of the subject of automaticity in health and disease. In health, this inhibitory power, which varies with individual growth and development, exercises a marked restraining influence over all mus-

cular movements that follow central cell activity, particularly all those movements that do not subserve a useful purpose. Exactly what this inhibitory power is, is still a question for physiologists and psychologists to determine. It is recognized as playing a most important part in the intellectual and physical life of man. Whether inhibition is a purely metaphysical attribute of mind or a special function having its seat in specific centres of the brain, its importance as a factor in the life of the individual cannot be doubted. Many writers have denied the existence of special inhibitory centres, and many physiological and psychological facts confirm their views.

G. H. Lewes, in "The Physical Basis of Mind," argues with much force against the existence of special centres of inhibition. He attempts to explain the phenomena of inhibition by what he calls the Law of Arrest. "The Law of Arrest," he says, "is only another aspect of the Law of Discharge, and may be regarded as the conflict of excitations." According to this theory, each nerve tract and centre possesses inherent inhibitory properties of its own. The strongest excitations prevail; "the discharge is only the resultant of the conflict along the line of least resistance, the arrest is the effect of the conflict along the line of greatest resistance."

Meynert advances the theory that the gray matter of the brain and cord presents a certain resistance to nerve conduction. Increased irradiation of any irritation is accompanied by increased resistance in nerve conduction. "It is evident, then," he says, "that inhibition, resulting from resistance introduced in nerve tracts, accompanies the simplest reflex processes."

This property of resistance may be increased by individual training and experience. The inhibitory power will, therefore, vary with the person; there is no universal inhibitory standard that can be applied to all alike. The most perfect inhibitory capacity is usually met with in those individuals that present a strong and healthy will power. Inhibition represents gradual growth, and varies at different periods in the life of the same individual. At birth and during early infancy, it scarcely exists. Every act that the infant performs is the impulsive and somewhat spasmodic response to sensory stimula-

tion. During childhood, the inhibitory power receives its first training and development. The child learns to govern himself. Experience and his parents teach him that the mere impulsive gratification of every whim that may arise, of every appetite that suggests itself, is not only not desirable, but may be fraught with disastrous results, both here and hereafter. In youth and manhood this power of inhibition receives constant education. The experiences of life all tend to develop it, if the will insists upon it. Finally, the inhibitory resistance, implanted in the nervous system in these various ways, is, to a certain extent, transmitted by heredity, so that those individuals, as well as races of men, present the most perfect manifestation of inhibitory power in whose ancestry this special faculty has been developed by training and experience.

Inhibition, therefore, seems to be a restraining power which is implanted in the mind, and incorporated as it were in the nervous mechanism of the individual. It is largely a matter of individual growth, and depends for its successful development upon the strong and healthy exercise of the will power. There is good evidence that inhibition is modified in various ways by climatic and hereditary influences. It is also evident that when once this inhibitory and restraining power is implanted within the nervous organization of an individual, its habitual and almost involuntary exercise is elicited by the presentation of the proper stimulus. Thus it is that habits and tendencies, which have only been repressed with the greatest difficulty and after the most active exercise of the will, receive frequent and comparatively easy restraint when once a tendency to their inhibition has been fairly established by the individual.

It is evident that this inhibitory power is intimately associated with all the higher faculties, and in common with them must seek expression through functional activity of the cerebral cortex. The inference is natural that functional or organic disturbance of this region should be attended by disordered inhibition. In health, the inhibitory function is exercised in a two-fold manner: *First*, in checking irrelevant trains of thought, repressing whatever is impertinent to the subject engaging the attention; and, *second*, in checking

certain muscular movements which, though they naturally succeed the stimulation that has preceded them, still for the time being and with other objects in view, are undesirable and out of place. It is with the general reflex motor disturbances, due to irregular and defective inhibitory action of the nerve centres of the central nervous system, that occur in the different phases of insanity, that this paper is chiefly concerned.

Normal muscular movement is the result of a certain transmission of nerve force from the central nerve centres along various efferent tracts to individual muscles. All such movements are either purposive in action, or, if involuntary, do not exceed the limitations established by health and which are recognized by all students of physical expression. Pathological motor activity, on the contrary, is spasmodic, irregular and purposeless. In diseased conditions of the brain, the pathological irritation of these delicate nerve centres may be so great as to overcome any acquired inhibitory resistance, and thus liberate an excess of nerve force, which will seek an outlet in the usual way by passing along efferent tracts to the muscles, and there appearing as muscular movements. Striking illustrations occur in cases of chorea and epilepsy. There seem good reasons for believing that in these diseases the brain cells are in an unstable condition, owing to hereditary, traumatic, or nutritive disturbances, and that, as Gowers says, the discharge of these same cells "may depend on the production of force within, being increased in excess of the resistance, or on the resistance being duly lessened."

In the functional and organic brain disturbance that accompanies insanity, pathological muscular activity and inactivity, are constant symptoms, and merit the careful study of the psychologist. The muscular disturbances of insanity are threefold, and represent three different central conditions.

1. *States of excessive nerve-muscular activity due to central irritation.* The constant muscular agitation of acute mania, *melancholia agitata*, the active stages of parietic excitement, and of many cases of recurrent mania, illustrate this form of motor activity. The central irritation is so great as to overcome all inhibitory resistance. The destructiveness, constant



paceing to and fro, jumping and running of patients of this class is an evidence of the purposeless, irregular, and spasmodic character of pathological motor activity due to morbid irritation of the central cells.

2. *States of deficient nerve-muscular activity due to central degeneration.* The general motor impairment that attends nearly all cases of permanent mental enfeeblement, and is witnessed in the slouchiness, feeble gait, and general helplessness of patients afflicted with terminal dementia, is an illustration of the deficient nerve-muscular activity that represents the degenerative processes occurring in the brain cells in nearly all cases of structural disease of that organ.

3. *States of automatic cell activity in the cerebrum, occurring not infrequently in acute insanity, and quite constantly in the chronic forms of the disease.* It is to this third form of pathological motor activity that this paper is especially limited.

The subject of automatic nerve activity is so well understood that any extended allusion to it would be superfluous. It has been a matter of frequent physiological observation that all nerve structure manifests a tendency toward automatic activity. This attribute, inherent in nerve tissue, is noticeable in the lowest forms of animal life, possessing only the simplest and most rudimentary suggestion of a nervous system. The ascidian, for instance, illustrates this peculiar mechanical and automatic action of a very simple organism that is wholly unprovided with anything like consciousness. The simple muscular movements that occur in this animal, upon the presentation of the proper stimulus, are entirely involuntary and reflex, and are always repeated in identically the same way during the life of the ascidian.

As we ascend the scale of animal life the nervous system becomes more complex; entire regions are specialized, one part becoming subordinate to another, until we reach man, in whom the completest subdivision and specialization has been attained. In him the higher centres in the anterior cerebral region preside over the nerve structures below in the brain and cord. Still even these more highly specialized

centres of the human brain manifest the same tendency to automatic and mechanical activity.

In one respect, however, man differs from the other forms of animal life. His *will power* presides over and directs those various processes which in the lower animals are automatic, instinctive, and largely involuntary. In man a few of the activities of organic life—such as respiration, the beating of the heart, and the like—are transmitted at birth fully established, and are entirely independent of the will. Other processes, such as walking, writing, and the like, are acquired after a most careful direction of the will, and laborious practice, and then become automatic. Still other higher processes, such as the psycho-intellectual activities of the individual, while under the guidance of the will, conform to the universal law of automaticity. Thought runs in certain well-established channels, and “ Mechanism in Thought and Morals ” is as susceptible of proof as the automatic action of the heart or the lungs during the processes of circulation or respiration—the only difference being that the intellectual and acquired activities are under the guidance of the will.

A high volitional power, therefore, distinguishes man from the lower animals. Even the most highly developed of these lower orders possess limited volitional power, while some would deny that they possess it at all. Many of their acts that seem to display a high degree of intelligence and to suggest the power of voluntary selection, prove, on closer examination, to be merely the result of unreasoning instinct that would not have admitted of any other course. In man, on the contrary, while his daily life is largely made up of various automatic activities, still the range of purposive selection is large, so that the “ mechanism of thought and feeling ” is made to serve the best interest of the individual through the guidance of the will.

In some way, at present obscurely understood, will power and functional activity of the cortex are mutually interdependent. Hence disturbance of these centres in insanity caused by impaired nutrition, defective functional activity, or more gross structural lesions weakens the will power of the individual. The functional activity of the cortical cen-

tres may be completely disarranged by insanity, and, as a result, the normal exercise of the will may be disturbed if not entirely suspended. At the same time, however, the activities of the basal ganglia, no longer under the guiding and controlling influences of the cortical centres, continue automatically. As a result, purposeless thought and action of an automatic character are quite apt to follow those serious disturbances of the higher cerebral centres during attacks of severe acute and especially of chronic insanity.

The inference is quite natural that in cases of extremely active acute mental disease and in a majority of the cases of terminal dementia, there is morbid disturbance of that region referred to by Dr. Lombard in the article previously cited: "the central nervous mechanisms that lie between the areas that originate the will impulse and the centrifugal nerves." In many cases of insanity that portion of the brain that "originates the will impulse" is cut off by reason of organic or functional disturbance, and consequently the areas that lie nearer the centrifugal nerves are left to act independently of will and inhibition. In Dr. Lombard's experiments these areas acted with a certain periodical variation, owing to processes of fatigue and recuperation; in cases of insanity this same region may display peculiar and persistent automatic activity by reason of cerebral excitation accompanied as it is with loss of function of the higher brain.

There is abundant clinical evidence in every hospital for the insane of this involuntary action of cerebral areas that lie between the centres originating will power and inhibition and the centrifugal nerves. In passing through wards containing the chronic and demented insane, one is struck with the evidence on every side of automatic activity. Here you will notice a man walking backward and forward in a mechanical way for hours together, until he has worn a beaten path in the floor; there will stand one who picks away at a certain place on his clothing for an indefinite period until he has worn the garment through to the skin. Quite frequently will be heard curious, meaningless noises, singular repetitions of words or sentences entirely meaningless. It is not an uncommon thing for a chronic patient to have some pecu-

liar word or phrase, or even a single articulate sound that he will repeat in an irrelevant way for years. In like manner you will meet with patients who make strange motions with the arms and hands, and maintain singular attitudes in a mechanical way. It is difficult to arouse the attention of such patients; their monotonous repetition of words and movements continues just the same regardless of the presence of others, and with little reference to any attempts made for their diversion. All this variety of automatic action and speech indicate that the healthy functional activity of the highest cerebral centres has been disturbed and partially suspended, and that other centres are acting in a mechanical manner and without the normal volitional and inhibitory control.

Prolonged automatic activity in thought, speech and action among the insane suggests a serious lesion in the higher brain. The more mechanical and purposeless the acts and words of the patient, the graver is the prognosis. The nervous system, indeed, manifests a striking tendency to mechanical repetition of any process once initiated within its centres. In health, habits and personal idiosyncrasy are illustrations of the facility with which automaticity is established in the central nervous system. The same tendency is equally noticeable in diseased conditions. One epileptic attack is likely to be followed by another, and a number of seizures renders the prospect of others quite certain, until in a short time the disease becomes firmly established. Both mania and melancholia manifest tendencies to repetitions of the attack, and each new attack renders the probability of another quite certain, until recurrence or permanent insanity is established.

It is when the inhibitory and volitional functions of the higher brain are suspended, and when unrestrained and undirected action occurs in those centres that are nearest to the outgoing motor tracts that the most peculiar evidences of automaticity are witnessed. In the advanced stages of fevers, such as typhoid and scarlatina, the higher functions of the mind are often suspended, either from exhaustion or because the cortical centres have been disturbed by the severity of the febrile action. In these grave physical conditions the auto-

matic and purposeless repetitions of words and muscular movements becomes quite noticeable. *Subsultus tendinum*, *carphologia*, tiresome utterance of some particular sound or word indicate that the higher cerebral functions have been suspended and that the lower centres are acting as it were at random and without the direction of the former. In this case the prognosis is grave because the vital forces themselves are waning and volitional activity is suspended through exhaustion of the cortical centres.

In chronic insanity the prognosis as to mental recovery of the patient may be equally grave, for the reason that healthy functional activity of the cortex has been permanently disturbed by the disease, which, though not necessarily fatal to life, is most assuredly so to mental restoration. The chronic insane are extremely liable to develop objectionable habits for the physiological reasons suggested. The special study of the physiological causes that underlie the peculiar habits so frequently met with in individual cases of insanity is both interesting and instructive.

Two laws underlie every form of nervous activity, and furnish a physiological explanation for the tendency toward the formation of strange habits and a certain automaticity in conduct and speech that is so frequently exhibited by the chronic insane, in whom it is to be remembered inhibitory impairment always exists.

1. The discharge of the nerve centres occurs along those tracts that offer the least resistance.

2. The more frequently the discharge occurs along a given line, and the weaker the inhibitory resistance, the easier does a repetition of the discharge become, and the more certain its permanent automatic establishment.

If, for instance, in those conditions of mental disease characterized by a weakening of the will power, one especial route is, for one reason or another, established on account of some delusion or mere fortuitous circumstance, the probability is that this particular route will continue to be the one most frequently traversed by nervous force in its passage from the brain to the periphery. A delusion, an hallucination of sight or hearing, some peculiar condition in the patient's environ-

ment may have first initiated certain actions which, by being unresisted and hence repeated, lead to the establishment of a habit. Probably in some such simple and purely fortuitous way are developed the pulling out of the hair, tearing the clothing, walking in a beaten path, making singular motions or uttering meaningless sounds; in fact, any of the strange habits of the insane. It matters little whether the performance of these habits is painful or disagreeable; no other alternative seems open to the patient when, through weakness of will and intelligence, the morbid route has once been established. Some morbid sensation in the scalp or chin to act as an excitor, or merely the absence of anything of an intelligent character in the mind to engage the attention, may lead to the plucking out of the hair or beard, which impulse, meeting with no resistance, soon develops into a persistent habit. A delusion about the bed may lead the patient into the habit of standing up all night, and, if not interrupted, nothing short of restraint will prevent exhaustion, so persistent will the impulse become to remain on the feet.

The importance of the early breaking up of bad habits among the insane will be readily understood. Fortunately, the same tendency to automaticity of action may be utilized in a good as well as a bad direction. By careful supervision, we may succeed in breaking up many useless and vicious habits by supplying some simple mechanical occupation for the hands, thereby utilizing the automatic nerve-activity characteristic of the disease. And in doing this, we may even seem to retard mental deterioration. Judiciously selected mechanical employment among the insane has become, therefore, a valuable means of treatment.

Strange postures, cataleptic attitudes among the insane, particularly those singular positions assumed by patients manifesting that particular group of symptoms, to which the name of *katatonía* has been given by some writers, possess the same interest for the psychologist as do the peculiar habits just mentioned. The significance of postures in health has been ably treated by Dr. Francis Warner in an article on "Muscular Movements in Man" in the *Journal of Mental Science* for 1889, April number. He says: "Postures depend upon the

ratios of nerve-muscular action, and to some extent they indicate the present ratios of static efferent force proceeding from the centres concerned. Observations show that the postures when not due to a present stimulus, or when produced by a weak stimulus from without, such as a sound or sight, correspond to and are signs of the general condition of the central nervous system." These remarks are particularly applicable to the singular attitudes seen in different cases of insanity. The postures that are oftentimes maintained for long periods by the insane are a pretty sure index of profound morbid disturbance of the central organ of innervation. Cases of *melancholia attonita* and chronic dementia afford the most frequent illustrations of morbid posture. The fantastic attitudes frequently associated with these two types of mental disease are undoubtedly due to the suspended functional activity of the higher brain. In melancholia this suspension of function may be only temporary, while in dementia it is permanent on account of structural changes that have occurred in the nervous centres. In stuporous melancholia the ideational centres appear to be almost functionally inactive. Either they are incapacitated by shock or impaired nutrition consequent upon a deteriorated state of the blood, or the slight activity they do retain, is restricted to the evolution of a single morbid and overwhelmingly insistent idea. The result is imperfect and misguided motor activity noticeable in perverted and meaningless posture. The condition itself, even though it is of recent date, is a serious one, and the prognosis is necessarily surrounded with doubt. So profound a disturbance of normal function in the ideational centres renders permanent instability of this region extremely probable, if it is not fatal to life itself.

The study of morbid postures among the insane is a subject of great psychological interest. The careful investigation into the early development of mechanical attitudes and movements, and meaningless habits among the insane, would amply repay the time and labor expended in this direction, and throw some light on the processes of cerebration and their connection with muscular movement. Quite frequently a single morbid dominant idea induces the patient to assume a peculiar attitude ; to this attitude no opposition is presented through the damaged

inhibition and volition, and, in a short time, the posture becomes permanent by reason of the continued transmission of efferent force along this particular route. So insidiously are these postures developed that before the physician is aware of it, they have become established, and the real causes that lead up to their final establishment are lost sight of. Among the chronic delusional insane that are well-advanced toward terminal dementia, a single active delusion leads to a peculiar posture or movement; this soon becomes permanent because the motor impulses, originated by the morbid insistent idea and having met with no resistance, continue to pass along this particular efferent route until automaticity is established. The original idea that initiated the posture, in fact, all active ideation, may cease as a result of the brain disease, and yet the peculiar motor condition will persist.

Case II, represented in the plate at the beginning of the article, illustrates an attitude taken by a young man suffering from melancholia with stupor. At the time the photograph was taken, the patient was laboring under a second attack of the same disease, which proved fatal in the course of a few months. He would stand in the posture represented both day and night unless held or restrained. His position was constrained and tense, usually one side a little more elevated than the other, his arms and hands maintained in a rigid position, and all his facial muscles in a state of extreme tension. This position was taken in a very early stage of his disease, at a time when it was possible to elicit a few ideas from him. In reply to the question why he maintained this uncomfortable posture, he replied that he felt positive his bowels would be more certain to act were he standing rather than seated or lying down. When asked to sit in a chair, he always protested, saying that he could not do so, and it was only by the exertion of some force that he could be induced to take a seat. His position, if seated, was one of intense constraint. Generally, he would only half sit in the chair resting one thigh, and apparently partially holding himself up with his feet or hands. These peculiar postures were undoubtedly maintained partly by the intensity of his delusion and partly by the failure of inhibition to restrain nervous energy from taking the particu-



lar efferent routes suggested by the morbid reasoning. Had this case entered a state of dementia secondary to his acute insanity, we might expect to see these same attitudes and movements continued in a mechanical and automatic manner long after the active delusion which first instigated them had ceased. Nerve-muscular activity having traversed the efferent routes leading to these particular groups of muscles, and having for so long a time met with weak resistance, it results that this route becomes permanent, as well as the easiest, and in this way a morbid posture is established. Should we see for the first time such a posture as is represented in Case II after it had been established many years, we should find an explanation extremely difficult. But had we been able to trace its gradual development from the active delusions of an acute insanity, we should quite readily understand the peculiar attitude and its relation to the mental condition at the present time.

Case I represents a peculiar posture that was maintained for hours by a patient laboring under an attack of melancholia with stupor. This young man made no remarks; he kept his eyes tightly closed so that the secretions would accumulate under the lids; he would stand or sit in a rigid position with his head thrown far back on his shoulders, and any effort to induce a change of posture met with firm resistance.

Cases III and IV show singular and uncomfortable attitudes occurring in conditions of chronic terminal dementia. The postures were gradually assumed by the patients while under the writer's care, and yet so very slowly were they initiated that they became fixed and habitual positions before any especial attention was called to the fact. In this way the real causes that led up to the final establishment of the habitual posture were lost sight of. From what was known of Case III, the impression would be readily formed that the patient, owing to delusions of suspicion or fear, or a dislike to seeing persons about, gradually acquired the habit of hiding the face, as is often witnessed among timid and bashful children. As this particular case became more demented, a position which was at first assumed as the result of an active delusion, finally developed into a permanent habit, simply because ner-

vous force flowing along this route from centre to periphery for so long a time in obedience to impulses derived from morbid ideas and meeting with little inhibition, continued to take this route long after active thinking had ceased.

Another interesting fact concerning these strange attitudes is the apparently analgesic condition of the patients themselves; they all seem utterly oblivious to the discomfort and even the painfulness of these constrained positions. Case IV would maintain the posture shown in the picture for hours continuously; and Case III, from the hour of rising until bedtime, was continually in the attitude shown in the photograph. That these postures would be painful to a person in health, any one can demonstrate by attempting to maintain similar positions for even a few minutes at a time. The muscles concerned in the maintenance of these postures were in a high state of tension, showing that a certain amount of "static efferent force" was being transmitted continuously from the centres within the sensorium to the periphery over these morbidly pre-established routes. Nearly all the healthy activities of mind appeared in these cases to have ceased, and there seemed little left beside the mere processes of organic life; apparently, the entire energy of the sensorium was expended in keeping up these automatic and useless positions. Any attempt to move the arms into a more easy position was met by a firm resistance, which was not spasmodic, but persistent in character.

In conclusion, it may be said that automatic activity of the cerebral centres in health is quite largely under the direction of volition and inhibition, and the result is motor activity that is purposive. Automatic activity of these same centres in disease of the mind seems to be less under the guidance of the inhibitory power and the will, and the resulting action appears purposeless. In proportion, as inhibition and volition are weakened by the brain disease, to just that extent do meaningless automatic activities prevail. Inhibition and volition both being identified with healthy functional activity of the highest centres in the cerebral cortex, it naturally follows that varying degrees of automatic muscular movement will characterize some acute and nearly all chronic insanities.